Waverly Street Bridge
Waverly Street Spanning George's Creek
Westernport
Allegany County
Maryland

HAER No. MD-83

HAER
MD,
1-WESPO,
1-

PHOTOGRAPHS
REDUCED COPIES OF MEASURED DRAWINGS
WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
Washington, D.C. 20013-7127

HAER
MD
1-WESPO
1-

HISTORIC AMERICAN ENGINEERING RECORD

WAVERLY STREET BRIDGE HAER No. MD-83
(WESTERNPORT BOWSTRING ARCH-TRUSS BRIDGE)

Location:	Spanning George's Creek in Allegany County, Maryland, located in the Town of Westernport, Maryland. UTM: 17.668325.4372725 Quad: Westernport, Md.-W.Va.
Fabricator:	Youngstown Bridge Company Youngstown, Ohio
Date of Construction:	1891-92.
Present Owner:	City of Westernport Box 266 Westernport, Maryland 21562
Present Use:	Vehicular Bridge-Closed Fall 1990 Removal/Relocation 1992
Significance:	The Waverly Street Bridge is significant as one of the few remaining bowstring arch-truss bridges in Maryland. The bowstring arch truss was one of the first metal trusses to be widely used in nineteenth century America. The Waverly Street Bridge was listed in the National Register of Historic Places in 1984.
Project Information:	This documentation was undertaken in October/November 1991 in accordance with a contract with the Allegany County, Maryland, Department of Public Works as a mitigative measure prior to the removal or relocation of the bridge, in accordance with Article 83-B, Section 5-618 of the Annotated Code of Maryland.

Lee R. Maddex
Research Assistant
Institute for the History of Technology
and Industrial Archaeology
West Virginia University
Morgantown, West Virginia 26506

Overview

The Waverly Street Bridge or the Westernport Bowstring Arch-Truss Bridge was the last remaining Bowstring Arch-Truss Bridge to be in service in the state of Maryland, and is one a few existing bridges of this type in the state. The Waverly Street Bridge was constructed in 1891 by the Youngstown Bridge Company, Youngstown, Ohio, and is representative of a significant and revolutionary nineteenth century bridge design that has all but disappeared from the American landscape. The Westernport Bowstring Arch-Truss Bridge spans George's Creek, which flows southerly through Allegany County into Westernport, where it joins the North Branch of the Potomac River. The George's Creek Coal Region was one of America's earliest coal mining regions to be exploited during the nineteenth century.

Westernport, Maryland

Westernport is nestled in the mountains of western Maryland, at the junction of George's Creek and the North Branch of the Potomac River. The town site is rich with history, being a natural encampment site for Native Americans, pioneers, fur pedlars, and others on their westward (and eastward) travels. The George's Creek Valley was a natural highway to Nemacolin's Path to the north and the Potomac River valley to the south, and the confluence of George's Creek and the North Branch of the Potomac River was the center of activities for several hundred years. These activities, however, were mostly transient in nature, with people coming and going. The first permanent settlement of the area occurred in the 1780s when Peter Devecmon, Cumberland merchant, purchased lands in the present Westernport area and established a stone grist mill. These holdings were acquired by James Morrison and Adam Sigler in 1790s. These men subsequently surveyed the land and laid out the present town of Westernport.[1] Westernport, once established, began to grow; the post office was opened in 1802 and the town was incorporated in 1857. The town is known as Westernport, because it is the head of navigation on the North Branch of the Potomac River, that is, the western most port. Historically, Westernport has also been known as "Hardscrabble," presumably because of the isolated nature of the area during the nineteenth century.[2]

---

[1] Henry I. Stegmaier, Jr., et al, Allegany County: A History (Parsons, WV: McClain Printing Co., 1976), pp. 85-86.

[2] Ibid, p. 140.

The discovery of coal in Barton, Maryland, the building of the George's Creek valley railroad, and the development of the pulp mill at Luke have had the greatest economic impact on Westernport. Coal was discovered in nearby Barton, Maryland in 1810. The vein uncovered following spring freshlets along George's Creek, became known as "Big Vein" because of its fourteen foot thickness. Semibituminous, or steam coal, was mined and transported to Westernport for river shipment to Washington, D.C. and other markets. By the 1840s, the George's Creek Field (the area bounded by Dans Mountain to the east, Savage Mountain to the west, the Pennsylvania border to the north and Westernport to the south) was being heavily exploited and the arrival of the Baltimore and Ohio Railroad at Cumberland, Maryland in 1842 (and later Piedmont, West Virginia), offered transportation of the coal to eastern markets. The B&O's arrival stimulated interest in constructing a railroad from Lonaconing to Piedmont. This railroad was constructed by the George's Creek Coal and Iron Company and was completed in 1852, connecting with the B&O at Piedmont. This road later became part of the Cumberland and Pennsylvania Railroad system and even later part of the Western Maryland Railroad. The development of the George's Creek railroad system was an important economic stimulant for the Westernport community.[3] Today, the importance of the railroad has declined, but mining still is a significant aspect of Westernport's economy, albeit surface mining. The other important development was the paper mill at nearby Luke.

In 1889, the Luke family acquired the Davis Saw Mill near Westernport, and enlarged the scope of its operations to include paper production. Five years later in 1894, the former saw mill had grown to nine buildings producing 40,000 pounds of paper daily. The West Virginia Pulp and Paper Company, as the operation came to be known, was successful due to the abundance of water and spruce trees for paper, and inexpensive coal for fuel. The business continued to grow and in 1920, the Luke, Maryland company employed close to 1,000 workers. The West Virginia Pulp and Paper Company in 1969 changed its name to the Westvaco Corporation. This corporate name change reflected the companies worldwide reputation as a leading producer of paper products.[4]

The town of Westernport has changed in the last hundred years most notably, with the construction of the new Route 36, which follows the George's Creek Valley, and the erection of new buildings. However, much of the town's historic fabric remains intact and George's Creek is still central to the community.

---

[3] R.A. Walter, "Historical Sketch of the George's Creek Coal Region," Coal Age 25 (1914): 995-1000; and Stegmaier, Allegany County, pp. 140-42.

[4] Stegmaier, Allegany County, pp. 221-222, pp. 400-403.

Like Westernport, there are many communities clustered along the banks of this historic watercourse. Access to these communities today, as in the past, has been via bridges interconnecting with the valley road. Even today, Westernport has only three highway bridges which cross George's Creek. One of these, is of course, the Waverly Street Bridge. Hence, the importance of bridges to communities like Westernport cannot be overstated.

General Bridge Description

The Waverly Street Bridge is a single span bowstring arch-truss bridge. The bridge has eight panels spaced at approximately 13'-6" intervals, with a total span length of 108'-1". The overall length of the structure is 110'-0". The clear span is 16'-0". The width of the deck between the trusses is 15'-7". The overall width of the bridge is 18'-4". The height of the bridge at the center transom is 15'-6" pin to pin, and the heights of the two companion transoms are 14'-7 1/4" pin to pin.

The Waverly Street Bridge is accessed from Main Street to the east and from State Route 36 to the west. The access from State Route 36 was recently built as a temporary bypass, due to the closing of the bridge.

The Waverly Street Bridge arches were fabricated in four sections. Each section of the arch has a square cross-section and was fabricated using mild steel[5] channels, with the legs outward, for the sides and mild steel plates on the top of the arch. The bottom of the arch was open, but has plates spanning the opening to add torsional rigidity to the arch. These plates are spaced at appoximately three foot intervals. Mild steel rivets are used in the shop fabrication of the arches, as with the other fabricated members. However, the bridge was erected in the field using mild steel nuts and bolts rather than shop rivets. Stress points, such as where members are joined, are built-up with gusset plates for added strength.

Pinned connections are used at all joints, in particular, where the lower chords, the columns, and arches are joined. The columns were fabricated using mild steel tees with single bar lattice and rivets. The pins are also mild steel.

Transoms were constructed in a similar fashion, using a mild steel tee for the top member, mild steel angle irons for the bottom member and tied together with single bar lattice for the center transom and single bar lacing for the companion transoms.

The lower chords were fabricated from mild steel flat stock and the ends were lap forged to form an eye. Similarly, the diagonals, and sway bracing were fabricated from rods, with lap forged ends forming eyes and upset ends for threading. The turnbuckles were fabricated using cast iron.

---

[5] No metallurgical analysis of the materials used in the fabricated members was undertaken. It is assumed that the materials used in the bridge's construction are mild steel, similar to modern ASTM A36 structural steel. This assumption is based on the widespread use of steel at time the bridge was fabricated.

Perhaps the most interesting feature of the bridge are the "fish belly" floor or water beams. The beams were fabricated using two wedge shaped mild steel plates and were joined together to form the beam. The beam was further strengthened with the addition of mild steel angles riveted to the beam along the top and bottom edges and two vertical torsional stiffeners. The floor beams were hung from the pin connections with the use of mild steel U-bolts.

The decking for the bridge is wood, with longitudinal stringers and transverse decking. This decking is not original to the structure. The original decking probably had the same configuration.

The shoes are made of cast iron, with the east shoes fixed and the west shoes free to move on a nest of rollers. The upset and threaded ends of the lower chords pass through the upper part of the shoes and are fixed with hex nuts. Additionally, the upper part of the shoes were cast to accept the arch ends.

The abutments were laid using cut stone. They are simple masonry walls or piers because there are no horizontal or transverse loads on the cut stone, only vertical loads. This is characteristic of the bowstring arch-truss bridge.

There is no evidence what color the bridge was originally painted. However, today the structure is painted battleship gray over a red lead primer coat.

Iron Bridge Construction

The use of iron (and later steel) in bridge construction was a monumental event. Even today, late in the twentieth century, we still speak of crossing the "old iron bridge" when giving directions. The use of iron as the principal building material in bridge construction, dates to the erection of the Great Iron Bridge over the River Severn, at Coalbrookdale, Shropshire, England in 1779. This was a watershed event which led to the use of iron as the construction material of choice during the Victorian era. (Witness the Crystal Palace of 1851, constructed entirely of iron and glass.) In America, the first iron bridge was built at Brownsville, Pennsylvania and carries the National Road over Dunlap's Creek. It was constructed in 1836 and, like the Coalbrookdale bridge, the Brownsville arch bridge was constructed completely of cast iron.[6] (The Brownsville arch bridge is still in service.)

Theodore Burr, who is noted for the "Burr Arch," was the first to use the bowstring arch in bridge construction. Burr constructed a five-span timber bowstring arch truss bridge across the Delaware River at Trenton, New Jersey in 1804 or 1806, that featured an arch with a suspended roadway.[7] The invention of the metal bowstring arch-truss has been attributed to Robert Fulton, the famous American inventor, noted for his steamboat, the "Claremont." Fulton envisioned his "counter-balanced" bowstring bridge to be used for aqueducts and canal bridges, but there is no evidence bridges of this design were ever erected in North America.[8]

The first patented American metal bowstring arch-truss was the Whipple Iron Bowstring Bridge. Invented by Squire Whipple, this bridge was patented in 1841. Whipple's bridge was constructed entirely of iron and featured cast iron arches with wrought iron suspenders. Whipple was the first American to apply scientific principles to bridge design with the use of simple trigonometric calculations to analyze the stresses within the structure. Whipple further refined his analysis into a tabular form, which was easily used by mechanics and other practical men, who could determine

---

[6] David Plowden, Bridges: The Spans of North America (New York: The Viking Press, 1974), pp. 57-58.

[7] Plowden, Bridges, p. 37; and William H. Shank, Historic Bridges of Pennsylvania (York, PA: American Canal and Transportation Center, 1986), pp. 8-9.

[8] Plowden, Bridges, p. 60.

member sizes for a given load requirement.[9] The Whipple bowstring bridge was considered an engineering marvel, and as such was emulated by other bridge engineers for the next thirty years with minor structural changes to avoid patent infringements.

One such emulator was Ohioan Thomas W.H. Moseley who, in 1857, patented an iron bowstring truss. Moseley established an early iron fabrication shop, the Moseley Iron Building Works in Boston, Massachusetts (established 1861), where among other practices he fabricated iron bridges.[10] Moseley's truss design, the "tubular arch" was triangular in cross-section and was fabricated from wrought iron boiler plate.

One of Moseley's agents was Zenas King, who left Moseley's firm to start the King Iron Bridge and Manufacturing Company, Cleveland, Ohio, perhaps the most famous of the iron bridge companies of the nineteenth century.[11] King's company erected literally thousands of bridges during its operations, including the bowstring arch-truss design. Moseley's and King's firms are early examples of the mail order or prefabricated bridge companies that were popular during the mid to late 1800s.

The Morse Bridge Company, Youngstown, Ohio was another company to form during the later part of this era of mail order bridge companies. It was founded by brothers Charles and Henry Morse in 1878. The Morse Bridge Company's designs were not ingenious, relying upon tried and true designs. The company had a well established reputation in bridge construction. A solid reputation along with a habit of price fixing, led the Morse Bridge Company to attain a high profit margin. The Morse Bridge Company works were destroyed by a fire in late 1887 or early 1888, causing the firm to cease operations.

The Haselton, Ohio plant site was purchased and reopened under the name of the Youngstown Bridge Company in about 1889. An 1891 advertisement for the Youngstown Bridge Company lists the following company officers: James Neilson, president; L.E. Cochran, vice president; W.L. Cowles, chief engineer; and B.F. Boyd, secretary

---

[9] David Weitzman, Traces of the Past: A Field Guide to Industrial Archaeology (New York: Charles Scribner's Sons, 1980), p. 51.

[10] Plowden, Bridges, p. 60.

[11] David Simmons, "Remarks by David A. Simmons at Iron Bridge Symposium," Poland, Ohio, 2 May 1987, unpublished manuscript, p. 1; and Victor C. Darnell, Directory of American Bridge-Building Companies 1840-1900 (Washington, D.C.: Society for Industrial Archeology, 1984), p. 56.

and treasurer. The same advertisement states that the company specialized in the manufacture of "iron and steel bridges, iron structural work, iron roofs and turn tables."[12]

The Youngstown Bridge Company was located along a Pennsylvania and Lake Erie Railroad siding, which facilitated the delivery of the finished trusses to the erection site. Sanborn Fire Insurance Maps of the period indicate that the firm expanded its operations during the 1890s, and by 1896 they had a complete fabrication shop, capable of fabricating and erecting any type of iron or steel bridge. These same maps seem to indicate that the Youngstown Bridge Company did not manufacture any iron or steel shapes, but apparently purchased rolled sections and plates from local mills or suppliers.[13]

The Youngstown Bridge Company was of 24 bridge fabricating companies purchased by steel magnate Andrew Carnegie, when he formed the American Bridge Company in 1900. Following the company's acquisition, the bridge works were closed and later demolished. Apparently the Republic Steel Company erected a mill on the old Youngstown Bridge Company property in the early 1910s. Today, there are virtually no extant Youngstown Bridge Company bridges, save a handful in Ohio and the Waverly Street Bridge.[14]

---

[12] Engineering-News Record 51 (1891): 27.

[13] Youngstown Sanborn Fire Insurance Map, 1889; and Youngstown Sanborn Fire Insurance Map, 1896.

[14] Simmons, "Remarks," pp. 3-4.

Waverly Street Bridge

In February 1891, the president of the Commissioners of Westernport reported that the town's bridges across George's Creek had become unsafe and "he prevailed upon the President of the [Allegany] County Commissioners[15] to repair the same."[16] This initial report set off a chain of events which lead to the erecting of the present Waverly Street Bridge. By mid-May 1891, the Allegany County Commissioners had decided that the county was not responsible for maintaining the Westernport bridges, but agreed to authorize the repair of the bridges using county funds.[17] During the mid-June 1891 meeting of the Westernport Commissioners, the president "reported that the prospect was encouraging as to an iron bridge in the near future across George's Creek in the town."[18] In early July the Allegany County Commissioners ordered an assessment of the Westernport Bridge to determine if it should be replaced, and if so to make arrangements with the town of Westernport for an in-kind contribution towards defraying the cost of constructing a new bridge.[19] Finally, at the early August meeting of the Allegany County Commissioners it was "ordered that an iron bridge be built across George's Creek in the town of Westernport, and that plans and specifications be gotten from Mr. Cadle, and also that proposals be received according to said plans and specifications."[20] On September 1, 1891 the Allegany County

---

[15] The Allegany County Commissioners for 1890-91 included: John Schiller, president; John J. Bell; Henry Williams; William Orr; Joseph B. Stollemeyer; John Stewart, clerk; and R.W. McMichael, attorney. Allegany County Commissioners Record 1888-1893, p. 263. County Commissioners Office, Allegany Courthouse Annex, Cumberland, Maryland.

[16] "Westernport Commissioners," Piedmont Herald, 13 February 1891, p. 3.

[17] "Westernport Commissioners," Piedmont Herald, 15 May 1891, p. 3.

[18] "Westernport Commissioners," Piedmont Herald, 19 June 1891, p. 3.

[19] "Minutes of the 7 July 1891 Meeting of the Allegany County Commissioners," Allegany County Commissioners Record 1888-1893, p. 481.

[20] "Minutes of the 4 August 1891 Meeting of the Allegany County Commissioners," Allegany County, Maryland Commissioners Record 1888-1893, p. 488.

Commissioners

> "went into executive session for the purpose of opening bids for the Westernport Bridge...Bids were filed by the Penn Bridge Co., Youngstown Bridge and others for the construction of the superstructure of the Westernport bridge according to plans etc, of the Youngstown Bridge Co., and the Youngstown Bridge Co., being the lowest bidder were awarded the contract for the sum of $21.74 per linear foot..."[21]

The Youngstown Bridge Company was awarded the contract to construct a new iron bridge across George's Creek at Waverly Street in Westernport in late 1891, however, it is unclear precisely when the bridge was erected or by whom. The fabricated bridge was delivered unassembled to Westernport and was probably shipped to Waverly Street via the Cumberland and Pennsylvania Railroad. Local tradition contends the bridge was assembled by White's Foundry, which was located near the bridge site. This tends to add credibility to this story.[22]

Additionally, there is no record of who constructed the abutments. Adam Lebeck, a local contractor, who did much of the local stone work, may well have been contracted to lay the abutments.

---

[21] "Minutes of the 1 September 1891 Meeting of the Allegany County Commissioners," Allegany County, Maryland Commissioners Record 1888-1893, p. 491.

[22] Donna M. Ware, Green Glades and Sooty Gob Piles: The Maryland Coal Regions Industrial and Archeological Past, A Preservation Guide to the Survey and Management of Historic Resources (Crownsville, MD: Maryland Historical and Cultural Publications, 1991), p. 139.

A Case for the Youngstown Bridge Company

The Waverly Street Bridge was listed on the National Register of Historic Places in 1984. In the nomination, the bridge is specified as being built by the King Iron Bridge Company. New research has revealed this is not the case. The are several reasons why this structure is not a King Iron Bridge Company bridge.

First, the King Iron Bridge Company was not erecting bowstring truss bridges at the time this structure was built. Additionally, the Waverly Street Bridge was constructed late in the bowstring arch-truss's period of significance, at a time that Youngstown Bridge was erecting unusual designs such as the 1899 Youngstown Market Street Bridge.[23] Secondly, King Iron Bridge Company used completely different vertical members in their bowstring design. King used a vertical rod with an outboard diagonal rod which formed a triangle and were connected to the floor system. Additionally, in the King Iron Bridge design the floor beams rested on the lower chords. In comparison, the Waverly Street Bridge floor beams are hung from the lower chords and the vertical members were fabricated from rolled sections.[24]

From these design differences, it is clear that the Waverly Street Bridge was not of the King Iron Bridge Company design or construction. Hence, based on this evidence and the Allegany County Commissioners records, the Waverly Street Bridge was, in fact, designed and built by the Youngstown Bridge Company.

The King Iron Bridge Company did construct a bridge in Westernport, Maryland in 1892. This is well documented in the National Register of Historic Places nomination for the Waverly Street Bridge and the Piedmont Herald. But where was this bridge located? Today there are three Westernport bridges crossing George's Creek and these seem to be also the historic crossings as well. One crossing is at Waverly Street. The other two crossings are located downstream, with one at Bridge Street and the other carrying State Route 135. A careful study of the literature available suggests the King Iron Bridge Company bridge erected in 1892, was probably located at Bridge Street.

---

[23] Simmons, "Remarks," p. 4.

[24] Interview with David A. Simmons, 25 October 1991, by Lee R. Maddex. David Simmons of the Ohio Historical Society, is the leading expert on the King Iron Bridge Company.